

BTEC Assignment Brief

Qualification	Pearson BTEC International Level 3 Diploma in Engineering (optional unit) Pearson BTEC International Level 3 Diploma in Mechanical Engineering (optional unit) Pearson BTEC International Level 3 Diploma in Aeronautical Engineering (optional unit) Pearson BTEC International Level 3 Extended Diploma in Engineering (optional unit) Pearson BTEC International Level 3 Extended Diploma in Mechanical Engineering (optional unit) Pearson BTEC International Level 3 Extended Diploma in Manufacturing Engineering (optional unit) Pearson BTEC International Level 3 Extended Diploma in Aeronautical Engineering (optional unit)
Unit number and title	Unit 29: Principles and Applications of Fluid Mechanics
Learning aim(s)	C: Examine the application of fluid linear momentum principles to nozzle systems and fluid turbine operation
Assignment title	3 The application of fluid linear momentum principles to nozzle systems and fluid turbine operation
Assessor	
Issue date	
Hand in deadline	

Vocational Scenario or Context	You have successfully completed part of an apprenticeship with a company that supplies components and equipment for pneumatic, hydraulic and propulsion devices and systems. Your current placement in the company is with the Design Department. The Department is responsible for designing bespoke solutions for customers as well as standard components and systems. You have been working with a Senior Design Engineer who has identified some knowledge and skills that you need to develop before you can understand customer requirements and apply them to the selection of components and incorporating them into systems.
Task 1	You have been asked to investigate the application of fluid linear momentum principles to nozzle systems and fluid turbine operation. To do this: Carry out investigations and observations into the effects of a jet of fluid on a surface:



	a) normal to the jet b) inclined to the jet You should research factors including momentum, mass flow rate and volumetric flow rate. In your report explain how your observations relate to Newton's second law and the rate of change of momentum. You should also: Evaluate how the principle of linear momentum and convergent nozzle systems are used in: c) a fire hose d) a rocket system A rocket has a total lift-off mass of $2 \times 10^6 \text{ kg}$. 80% of the mass is the propellant fuel. The rocket consumes fuel at a rate of $5 \times 10^3 \text{ kg/s}$ and the exhaust gases have a constant velocity of 6 km/s. Calculate: e) the time for all the fuel to be used f) the thrust produced g) the net force on lift-off h) the initial acceleration • In addition, you should: Evaluate how fluid linear momentum principles are applied to i) the optimised operation of the Pelton impulse hydraulic turbine j) gas turbine engine.
Checklist of evidence required	A report covering the nature and analysis of fluid linear momentum principles and their application to the operation of rocket, nozzle systems and fluid turbines. supported by • images, • descriptions • mathematical modelling • calculations • evaluations All information and image sources should be referenced to an appropriate standard.

**Criteria covered by this task:**

Unit/Criteria reference	To achieve the criteria you must show that you are able to:
29/C.D3	Evaluate the nature of linear momentum principles and their application in determining fluid flow parameters and optimise the operation of nozzle systems and fluid turbines.
29/C.M5	Analyse the nature of linear momentum principles and their application in determining fluid flow parameters and the operation of nozzle systems and fluid turbines.
29/C.P6	Explain the nature of linear momentum principles and their application in determining fluid flow parameters and the operation of nozzle systems and fluid turbines.

Sources of information to support you with this Assignment**Books**

BTEC Level 3 National Engineering Student Book (Level 3 BTEC National Engineering); Buckenham et al; Pearson Education (2010); ISBN-13: 978-1292141008

Mechanical Engineering; Darbyshire A; Routledge (2010); ISBN-13: 978-0080965772

Mechanical Engineering Principles; Bird, Ross; Routledge (2014); ISBN-13: 978-1138781573

Websites

miniphysics.com/a-level-physics-revision-notes-junior-college-physics-h1-h2.html

learnengineering.org/2013/08/pelton-turbine-wheel-hydraulic-turbine.html

freestudy.co.uk

Above are some examples of websites. Further useful resources may be found at

qualifications.pearson.com/en/support/published-resources.html#step1